

Application Number; 10/084, 072  
Group Art Unit Number; 3635  
Filing date; 02/27/2002  
Name of the examiner who prepared  
the most recent office action;  
Mr. MCDERMOTT, KEVIN  
Title of invention;  
SUPPORT STRUCTURE FOR ISOLATING  
EARTHQUAKE MOTIONS

Amended SPECIFICATION

SUPPORT STRUCTURE FOR ISOLATING EARTHQUAKE  
MOTIONS

BACKGROUND OF THE INVENTION;

The present invention has to do with a support structure for isolating earthquake motions, and more particularly, to a structure to prevent a chain vibrations of the structure from earthquake and/or wild storm such as hurricane etc.

Heretofore, conventional earthquake-proof constructions are based on methods to alleviate gearing of earthquake motions by intermediately connecting elastic materials such as springs, rubber, lead, and balancer etc. between said

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foundation and bottom of structure.

Present invention is to provide another unique  
method to isolate linkage vibration of the  
earthquake and wild storm to above upper part of  
a structures taking advantages of friction-  
less nature in point contact rolling of a number  
of large and small steel balls rolling in point  
contact.

#### SUMMARY OF THE INVENTION:

The present invention is designed was made to  
put a constructions on a collective block of fri  
ctionless large and small steel balls.

Explaining my invention in more detail, the

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device is designed to interpose large and small balls between pressure-receiving spherical curved steel plate and pressure-applying spherical curved steel plate surfaces as shown in annexed drawings (Fig. 2-A~Fig. 2-C), hence transmission of earthquake motions are isolated by above said rolling of two types of balls interposed between the two curved spherical surfaces as soon as earthquake occurs. This is the case just like the case of a ship on the water, in which we have no earthquake feeling since trembles are isolated by allowing the waving water to receive and transform them into rolling forces of the water wave.

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A preferred form of the present invention is  
illustrated in the accompanying drawings in  
which:

Fig. 1 is a plan view of the invention showing a  
foundation hoop trembled from the east to the  
north direction.

Fig. 2-A is a sectional view of a composition of  
fundamental foundation hoop, a colum, and a  
foundation showing a frictionless slide of the  
invention.

Fig. 2-B is a sectional view of a main portion  
of the invention where the large and small balls  
arranged between two spherical steel plates  
showing a frictionless slide part of the inven-  
tion.

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Fig. 2-C is a enlarged sectional view of the  
same portion of the invention where large balls  
and small balls are shown in large scale.

Fig. 2-D is a sectional view of a foundation por-  
tion with a colum in image.

Fig. 3 is a imaginary view of a linkage movement  
of a foundation hoop when an earthquake occurs.

Fig. 4 is a perspective view of a sliding frame  
for sliding balls when earthquake motions were  
isolated.

Fig. 5 is a perspective view of the hoop of the  
invention.

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Fig. 6 is a perspective view of the hoop of the invention.

Fig. 7 is a perspective view of the portion which closed for large balls and opened for small balls.

Fig. 8 is a sectional view of press working of a concave curved surface and a convex curved surface.

Fig. 9 is a partial perspective view of a holes.

Fig. 10 is a partial perspective view of a frictionless sliding concave portion.

Referential numerals in the drawings;

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2--connecting bolts of for conncting a convex  
curved surface and with concave curved surface

3--pressure-receiving large steel balls (10.818mm9 in  
usual case)

4--rolling unifying small balls (8.73mm in usual case) in  
point contact

5--concave steel plate with pressure-receiving  
surface

6--convex steel plate with pressure-applying  
spherical surface

7--ball aligning frame

8--sodium silicate

9--colum

10--liquid replenishing pipe

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11--liquid sealing packing

12--polybiny1 chloride ball cover

13--concrete covering all the surface of top  
and bottom steel plate

14--connecting steel frame for hoop tightening

15--connecting steel frame for hoop-tightening

16--iron and steel reinforced concrete block

17--bolts for pressing ball surface

18--pressing bolts and nuts

19--tightening portion for balls

20--concrete frame

21--pressing slot

22--iron frame for ball surface

23--foundation hoop (same as numeral 1)



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24--hoop tightening frame

25--ball sliding block

#### DETAILED DESCRIPTION OF THE INVENTION:

According to my invention, large steel balls (3)  
and small steel balls (4) are interposed between  
pressure-receiving spherical curved steel plate 5  
and pressure-applying steel plate (6) as shown in  
the drawing 1 (Fig2-A~Fig. 2-C).

The peripheral scales of these plates are adjusted  
with that of a bottom of a structure such as a  
house or building to be built.

These plates are made of steel and used as a  
ball receiver.

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The shape of said pressure-receiving plate (5) is recessed concave formed one and another pressure applying plate (6) is convex formed one.

These opposing facing spherical plates are used as foundation of the building and also for the purpose of isolating earthquake mortions as described follows.

Pressure-receiving steel balls (3) and pressure-applying small balls (4) with (less accuracy) smaller diameter than that of pressure-receiving large balls are mounted to come in point contact in all direction.

The pressure-receiving concave curved surface (5) is supported by the pressure-receiving steel

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balls (3) and as soon as earthquake would occures,  
the linkage of earthquake motions to the building  
is  
isolated by the rolling slide of said pressure-  
receiving steel balls (3).

As to the structure of the foundation, a concrete  
material covering all the surface of top and  
bottom steel plate with large balls and small  
balls interposed between them except curved  
surfaces of the top and bottom plates constitutes  
a colum (9) and the same apples to the foundation.

The colum (9) including the pressure-applying  
convex-curved surface is jointed to the found-  
dation including pressure-receiving concave-

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When the pressure-receiving balls (3) are rolled by the earthquake motions, small balls (4) interposed throughout the whole periphery of said large balls (3) are rolled simultaneously, in which, as before described, the linkage of earthquake motions to the structure or building is isolated by the rolling slide of the pressure-receiving large and small steel balls. To cope with jump-up phenomenon caused by directly unde earthquake or float-up phenomenon caused by typhoon etc., the hoop (1) is put on the foundation. The hoop (1), without striving against linkage of earthquake motions, supports colum (9) together

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with the foundation.

Because the steel balls (4) moves to the side of higher foundation pressure—receiving curved surface when the building moves due to hurricane, building mounted on the foundation hoop (1) leans toward the wind pressure direction and increases resistance.

In addition, in order to completely achieve functions of this device, materials with properties of sodium silicate (8), etc., are filled with their properties of rust prevention, anti-freezing, and lubricant maintained are filled and functions of isolating earthquake are held semi-permanently.

The pressure applying and receiving steel plates

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are HRC50 and are free of dent when tested for  
withstanding pressure at 1 ton using pressure-  
receiving steel balls.

Concrete with strength of KGICM/700 are used.

When this invention apply to the colum with  
cross section of 80cmx80cm, the pressure-receiving  
force of 3,200 ton is obtained.

#### STRUCTURING PROCESS OF THE INVENTION:

1. viscous materials with properties of rust pre-  
vention is spread and coated onto the plane  
steel plate on spherical curved iron and steel  
flame adjusted so as to fit to a projected st-  
ructer.
2. fit the hole cast in a projecting pole of

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position frame.

3. Insert all large balls (3) into large holes
4. Large balls (3) are kept free movement, then  
all small balls are cast in free movement.
5. Suffice the NA2S108 to concrete mortar par-  
tition plate by supply pipe, then steel plate  
and block composed iron and steel frame are  
piled on them.
6. Concaved and convexed slide blocks are put on  
press ditch (Fig. 7) and press it by short-term  
clamp bolt-nut by which concaved and convexed

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spherical surface are made.

7, Construct a provisional concrete frame, then  
put concrete into above structured frame.

8, When applying weight reached to exceeding level  
of steel plate repulsion, provisional frame is  
solved.

9, Fundamental hoop (1) is connected to combined  
hoop, tightening frame by scale of  $1/4$  (Fig. 6).

By this proceeding the hoop aligns with earth-  
quake motion and wind pressure succesfully.